

Hamid Charkhkar**CONTACT
INFORMATION****Office:**

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EDUCATION**George Mason University (GMU), Fairfax, VA**

Ph.D., Electrical and Computer Engineering, '09 - '15

- Thesis Topic: *Microelectrode arrays for neuronal recordings: developing novel technology and applications*
- Advisor: Joseph. J. Pancrazio, Ph.D.

Ferdowsi University of Mashhad (FUM), Mashhad, Iran

B.Sc., Electrical Engineering, '00 - '05

**RESEARCH &
RELEVANT
PROFESSIONAL
EXPERIENCE****Postdoctoral Scholar**

Aug. '15 - Present

Department of Biomedical Engineering, Case Western Reserve University,
Cleveland, OH

&

Advanced Platform Technology (APT) Center,
Louis Stokes Cleveland Department of Veteran Affairs Medical Center (LSCDVAMC),
Cleveland, OH

Technical:

- Successfully demonstrated the feasibility of restoring natural sensation in lower limb amputees by delivering electrical stimulation to the peripheral nervous system.
- Programmed and controlled the delivery of electrical stimulation to peripheral nerves in human amputees, and collected data in real time.
- Developed necessary electronic circuits and computer codes to interface an instrumented prosthesis with an external electrical stimulator.
- Assessed the chronic performance and stability of high-density cuff electrodes installed on peripheral nerves of human subjects.
- Characterized the elicited sensory modality, intensity, and location in response to various stimulation parameters.
- Designed and performed experiments to examine the impact of sensory feedback in lower limb amputees

Administrative:

- Ensured steady project progress by coordinating between the technical and clinical teams consist of physicians, nurses, engineers, and graduate students.
- Prepared and presented monthly and quarterly reports to the funding agency, Defense Advanced Research Projects Agency (DARPA).
- Actively participated in writing grant proposals submitted to DoD & DARPA. The submission to DARPA resulted in acquiring new funds and extending the project timeline to recruit more participants.
- Prepared the regulatory documents to obtain Institutional Review Board (IRB) and its subcommittees' approvals. The submission was for a non-minimal risk research study.

- Provided technical assistance to obtain FDA Investigational Device Exemption (IDE) approval.
- Developed statement of the work and project timeline with milestones and deliverables.
- Built collaboration and closely worked with partners in industry (Ohio Willow Wood and Ottobock), academia (Case Western Reserve and University of Utah), and government (Department of Veteran Affairs and DARPA) to achieve the project's goals.

Graduate Research Assistant

'10 - '15

Neural Engineering Lab., Dept. of Electrical Engineering, George Mason University, Fairfax, VA

- Developed a functional neurotoxicity assay to determine the biocompatibility of novel materials for brain-computer interface. This work was published in Biosensors and Bioelectronics in 2014.
- Studied the effects of carbon nanotubes and conductive polymer-coated electrodes in neuronal recordings *in vitro*. This work was published in Proceedings of Engineering in Medicine and Biology Conference (EMBC) in 2014.
- Investigated long-term stability of PEDOT, a conductive polymer, for neuronal recordings *in vivo*. This work was published in Acta Biomaterialia in 2014 and 2016 (two separate articles).
- Demonstrated the long-term neuronal recordings of shape-memory polymer intracortical probes. This work was published in Journal of Biomedical Materials Research Part A.
- Developed and tested disposable low-cost microelectrode arrays *in vitro*. This work was published in Sensors and Actuators B. in 2012 and 2016 (two separate articles).
- Designed a functional drug screening assay for β amyloid, a biomolecule associated with Alzheimer's disease. This work was published in Brain Research in 2015.
- Assisted in implementation of a voice controlled wheelchair with humming control technique. This work was published in Computer Methods and Programs in Biomedicine in 2013.

Research Intern

SU'10

Center for Devices and Radiological Health, Food and Drug Administration (FDA), White Oaks, MD

- Conducted optical coherence tomography imaging of retinal tissue under electrical stimulus. This work was published in Journal of Neural Engineering in 2011.
- Quantified induced damage to retinal tissue due to electrical stimulation by processing histological H&E images in MATLAB. This work was presented in 2010 Intern Presentation poster session at FDA.

Electrical Engineer

'07 - '09

Moniran Engineering Consultant Company, Mashhad, Iran

- Planned and supervised factory acceptance testing for dispatching and power telecommunication systems.
- Inspected and reviewed work performed by instrument contractors for performance, quality, and cost.
- Assisted engineering teams and contractors by communicating technical ideas in the presentations and reports to make sure required design standards were met.

Undergraduate Research Assistant

'04 - '06

Integrated Systems Lab., Ferdowsi University of Mashhad, Mashhad, Iran

- Designed and simulated MOSFET-only capacitors for analog-to-digital converters. This work was published in Proceedings of ISCAS IEEE conferences in 2005.

- Simulated and analyzed switched-capacitor filters using 0.18 μm CMOS technology. This work was published in Proceedings of ICM IEEE conferences in 2005.

JOURNAL
PUBLICATIONS
(PEER-REVIEWED)

1. D. Simon, **H. Charkhkar**, ... , W. Voit, J. Pancrazio. Design and demonstration of an intracortical probe technology with tunable modulus. *Journal of Biomedical Materials Research Part A* . 105(1), 159-168, 2017 [IF: 3.2]
2. **H. Charkhkar**, G. Knaack, D. McHail, H. Mandal, N. Peixoto, J. Robinson, T. Dumas, J. Pancrazio. Chronic intracortical neural recordings using microelectrode arrays coated with PEDOTTFB. *Acta Biomaterialia*. vol. 32: 57-67, 2016. [IF: 6.1]
3. **H. Charkhkar**, D. Arreaga-Salas, T. Tran, A. Hammack, W. Voit, J. Pancrazio, B. Gnade. Novel disposable microelectrode array for cultured neuronal network recording exhibiting equivalent performance to commercially available arrays. *Sensors and Actuators B: Chemical*. vol. 226: 232-238, 2016 [IF: 4.2]
4. **H. Charkhkar**, S. Meyyappan, E. Matveeva, J. Moll, D. McHail, N. Peixoto, R. Cliff, J. Pancrazio. Amyloid beta modulation of neuronal network activity *in vitro*. *Brain Res*. vol. 1629:1-9, 2015 [IF: 2.8]
5. H. Mandal, G. Knaack, **H. Charkhkar**, D. McHail, J. Kaste, T. Dumas, N. Peixoto, J. Robinson, J. Pancrazio. Improving the performance of poly(3,4-ethylenedioxythiophene) (PEDOT) for brain machine interface applications. *Acta Biomaterialia*. 10(6), 2014. [IF: 6.1]
6. **H. Charkhkar**, C. Frewin, M. Nezafati, G. Knaack, N. Peixoto, S. Sadow, J. Pancrazio. Use of cortical networks for *in vitro* material biocompatibility testing. *Biosensors and Bioelectronics*. vol. 53, 2013. [IF: 7.4]
7. G. Knaack, **H. Charkhkar**, F. Hamilton, N. Peixoto, T. O'Shaughnessy, J. Pancrazio. Differential responses to ω -Agatoxin IVA in murine frontal cortex and spinal cord derived neuronal networks. *Neurotoxicology*. vol. 37, 2013. [IF: 3.3]
8. N. Peixoto, H. Nik, **H. Charkhkar**. Voice controlled wheelchairs: Fine control by humming. *Computer Methods and Programs in Biomedicine*. vol. 112, 2013. [IF: 1.8]
9. **H. Charkhkar**, G. Knaack, B. Gnade, E. Keefer, J. Pancrazio. Development and demonstration of a disposable low-cost microelectrode array for cultured neuronal network recording. *Sensors and Actuators B: Chemical*. vol. 161, 2012. [IF: 4.7]
10. E. Cohen, A. Agrawal, M. Connors, B. Hansen, **H. Charkhkar**, J. Pfefer. Optical coherence tomography imaging of retinal damage in real-time under a stimulus electrode. *Journal of Neural Engineering*. vol. 8, 2011. [IF: 3.4]

BOOK CHAPTERS

1. G. Knaack, **H. Charkhkar**, S. Cogan, J. Pancrazio. Chapter 8 - Amorphous Silicon Carbide for Neural Interface Applications, In *Silicon Carbide Biotechnology (Second Edition)*, edited by Stephen E. Sadow, Elsevier, 2016, Pages 249-260.

CONFERENCE
PUBLICATIONS
(PEER-REVIEWED)

1. **H. Charkhkar**, G. Knaack, H. Mandal, E. Keefer, J. Pancrazio. Effects of carbon nanotube and conducting polymer coated microelectrodes on single-unit recordings *in vitro*. Proceedings of 36th Annual International Conference of the IEEE, Engineering in Medicine and Biology Society (EMBC'14), Chicago, IL, Aug. 2014, pp. 469-473.

2. F. Hamilton, A. Akhavian, G. Knaack, **H. Charkhkar**, S. Minnikanti, W. Kim, J. Kaste, N. Peixoto. Dynamic steering of *in vitro* cortical neurons using field stimulation. Proceedings of 36th Annual International Conference of the IEEE, Engineering in Medicine and Biology Society (EMBC'14), Chicago, IL, Aug. 2014, pp. 6577-6580.
3. **H. Charkhkar**, A. Asadi, R. Lotfi. A 1.8 V, 10-bit, 40MS/s, MOSFET-only pipeline analog-to-digital converter. Proceedings of IEEE International Symposium on Circuits and Systems (ISCAS), Greece, May 2006, pp. 5363-5366.
4. R. Ghasemi, **H. Charkhkar**, A. Asadi, R. Lotfi, K. Mafinejad. Design of low-voltage MOSFET-only switched-capacitor filters. Proceedings of IEEE International Conference on Microelectronics (ICM), Pakistan, December 2005, pp. 24-29.

POSTER
PRESENTATIONS

1. S. Gok, **H. Charkhkar**, J. Pancrazio, M. Sahin. *In vivo* impedance characterization of PEDOT:TFB coated and chronically implanted multi electrode arrays. Biomedical Engineering Society (BMES) Annual Meeting, Tampa, Florida, Oct. 2015.
2. D. McHail, **H. Charkhkar**, G. Knaack, H. Mandal, J. Kaste, J. Robinson, J. Pancrazio, T. Dumas. Assessing novel materials to improve chronic cortical implants. Society for Neuroscience (SfN), Washington D.C., Nov. 2014.
3. **H. Charkhkar**, G. Knaack, H. Mandal, D. McHail, J. Kaste, J. Robinson, T. Dumas, J. Pancrazio. Assessing the stability of PEDOT-coated electrodes for chronic cortical implants. Neural Interfaces Conference 2014 (NIC'14), Dallas, Texas, Jun. 2014.
4. **H. Charkhkar**, G. Knaack, M. Wechsler, E. Keefer, J. Pancrazio. CNT/PEDOT coatings improve neural recordings and affect network structure. Neural Interfaces Conference 2012, Salt Lake City, Utah, Jun. 2012.
5. G. Knaack, F. Hamilton, **H. Charkhkar**, N. Peixoto, J. Pancrazio. Unit specific responses to ω -agatoxin in a cultured neuronal network. 8th International Meeting on Substrate-Integrated Microelectrode Arrays. Reutlingen, Germany, July 2012.
6. **H. Charkhkar**, G. Knaack, G. Pollack, R. Robbins, B. Gnade, J. Pancrazio, E. Keefer. Design of a novel low-cost MEA for high-content/high-throughput experiments with excitable cells. Biomedical Engineering Society Annual Meeting, Hartford, Connecticut, Oct. 2011.
7. **H. Charkhkar**, E. Cohen. Semi-automatic measurement of damage in stimulated H&E sections of retinal regions. OSEL/FDA Student Science Poster Exhibit, White Oak, Maryland, Aug. 2010.

INVITED TALKS &
SEMINARS

1. Peripheral neural interface technology to restore sensation in lower limb amputees, University of Texas Dallas, Richardson, TX, December 1, 2016.
2. Restoring natural sensation in lower limb amputees, Case Western Reserve University, Cleveland, OH, October 28, 2016 (Neural Engineering Center Seminar).
3. Microelectrode arrays for neuronal recordings. Electrical Engineering Department, George Mason University, Fairfax, VA, May 27, 2015 (Electrical Engineering Department Seminar)
4. Amyloid beta modulation of neuronal network activity *in vitro*. Unit of Clinical and Transnational Neuroscience, National Institute of Aging (NIA), Baltimore, MD, March 26, 2015.

5. Assessing the biocompatibility and stability of novel materials for chronic cortical implants. Louis Stokes Cleveland Veterans Affairs Medical Center, Cleveland, OH, March 3, 2015.

AWARDS	• Provost Dissertation Fellowship, GMU	SU'15
	• Graduate Research Fellowship, Dept. Bioengineering, GMU	F'10 - S'15
	• Graduate Students Travel Award, GMU	SU'14
	• Volgenau School of Engineering Academic Fellowship, GMU	F'11 - S'12
	• Oak Ridge Institute for Science and Education (ORISE) Fellowship	SU'10

TEACHING, LECTURES, & MENTORSHIP	Teaching & Lectures:	
	• ECE 334: Linear Electronics Lab, Dept. Electrical Eng., GMU	F'09 & S'10
	• "Materials for neuronal interfaces <i>in vitro</i> ," BENG 341: Introduction to Biomaterials, Bioengineering Dept., GMU (Guest lecture).	Jul. '13
	• "Microelectrode arrays and their applications in neuroscience," NEUR 410: Current Topics in Neuroscience, Dept. of Psychology, GMU (Guest lecture)	Nov. '11
	• Analytic Geometry and Calculus II, Dept. Civil Engineering, FUM	F'03 - F'04

Mentorship:

APT Center, Louis Stokes Cleveland VA Medical Center

- Breanne Christie, graduate student S'17
Developed series of psychophysical experiments to determine the latency of perceived sensation in response to electrical stimulation
- Neha Anilkumar, graduate student S'17
Integrated insole sensors to a prosthetic foot and interfaced the sensor data to external stimulator

Neural Engineering Lab., GMU

- Thao Tran, undergraduate research assistant
Received Undergraduate Research Scholars Program (URSP) award S'15
Co-author on the article published in *Sensors and Actuators B: Chemical* - 2016
- Susheela Meyyappan, undergraduate research assistant
Received URSP award S'13
Co-author on the article published in *Brain Research* - 2015
- Jemika Kaste, lab technician with BSc in Biology S'12-S'14
Co-author on the article in *Acta Biomaterialia* - 2014
- Beom Seo Koo, undergraduate research assistant F'13 - S'15
- Lydia Andrawis, undergraduate research assistant F'13 - S'14
- Parham Ghasemi, undergraduate research assistant F'13
- Meena Rezazad, high school student SU'13

PROFESSIONAL SERVICE	STEM outreach activities:	
	• Interactive STEM workshop for 10th and 11th graders, W.E.B. DuBois Scholars Institute, held at Princeton University, NJ	Mar. 3-5, '17
	• Co-hosted (with Dr. Nathalia Peixoto) lab visits and provided hands-on experience to promote STEM education:	
	– Centerville High School Math Club (24 students)	Apr. 9, '15

- MasonU: underrepresented student populations in K-8 schools (35 students) Mar. 7, '14
- Bioengineering and Robotics for 8th graders (43 students) Oct. 18, '13
- Girl Scouts (4th and 5th grade) (15 students) Nov. 5, '13

Served as a judge in the following events:

- Northern Virginia Regional Science and Engineering Fair - Works of students in Grades 7 through 12 from schools in Alexandria, Arlington, and Falls Church City, VA March 1, '14
- Support of Undergraduate Research & Creative Endeavors (SOURCE) poster session, Case Western Reserve University Dec. 4, '15
- IEEE Region 2 Student Activities Conference, Cleveland State University Apr. 9, '16
- Research ShowCASE undergraduate poster presentation, Case Western Reserve University Apr. 15, '16

Invited manuscript reviewer:

- Journal of Rehabilitation and Assistive Technologies Engineering '17
- Acta Biomaterialia '16
- 2D Materials '16
- Journal of Rehabilitation Research and Development '15
- Biotechnology Letters '14
- Journal of Mason Graduate Research '14 - '15
- IEEE Engineering in Medicine and Biology Society (EMBS) Conference '12, '16, '17
- 10th International Conference on Biomedical Electronics and Devices '16

- MEDIA COVERAGE
- [On small business: story on international students in the STEM field.](#) Washington Post (J.D. Harrison) Apr. 21, '13
 - [Mason Professors Win Virginia Center of Aging Grant.](#) Connection Newspapers (M. Campbell) Oct. 5, '14
 - [Cultured neuronal networks on microelectrode arrays as a platform for screening potential Alzheimers drugs.](#) ALTTOX: methods for non-animal testing (Sherry Ward) Aug. 5, '16
 - [Bionics.](#) TV show: VICE on HBO (produced by Eric Weinrib) To be aired in March '17

- AFFILIATIONS WITH JOURNALS & CONFERENCES
- Associate editor for *International Journal of Biosensors and Bioelectronics*
 - Editorial Board member for *Insights in Biomedical Engineering*
 - Reviewer Board member for *The Scientific Pages of Biomedical Research*
 - Program Committee Member for *International Conference on Biomedical Electronics and Devices (BIODEVICES'17)*

- MEMBERSHIPS
- Institute of Electrical and Electronics Engineers (IEEE)
 - Engineering in Medicine and Biology Society (EMBC)
 - Society for Neuroscience (SfN)
 - Biomedical Engineering Society (BMES)
 - National Postdoc Association (NPA)

- TECHNICAL SKILLS
- **Clinical Research:** Experience in design and characterization of nerve cuff electrodes; Delivering safe electrical stimulation to peripheral nerves; Experience in acquiring regulatory approvals including requirements for IRB and FDA IDE submission and review process; Surgical planning for implant surgery; Effective communication skills to obtain informed consent

- **Electrophysiology:** Extracellular recordings *in vitro* & *in vivo* and analysis, Stimulating neuronal networks with electrical or chemical stimuli, Experience in stereotactic surgery on rodents, Whole-cell patch clamp (neurons & PC12 cells)
- **Cellular & Molecular Biology:** Primary neuronal cell culture, Cell and tissue fixation, Immunohistochemistry (IHC), handling rodents (rat & mouse)
- **Electrochemical Characterization:** Electrochemical impedance spectroscopy (EIS), Cyclic voltammetry (CV), Electrochemical deposition of conductive polymers and metals, Accelerated aging, Bio-impedance modeling
- **Microscopy:** Fluorescence microscopy, Scanning electron microscopy (SEM)
- **Software:** MATLAB and Simulink, xPC target, COMSOL, OrCAD, AutoCad, C++, R, SPSS, Vicon Motion Capture, L^AT_EX